UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/955,668	09/19/2001	Shuzo Sato	09792909-5187	1236

33448 7590 10/22/2003

ROBERT J. DEPKE LEWIS T. STEADMAN
HOLLAND & KNIGHT LLC
131 SOUTH DEARBORN
30TH FLOOR
CHICAGO, IL 60603

EXAMINER	
NICOLAS, WESLEY A	
ART UNIT	**PAPER NUMBER**
1742	

DATE MAILED: 10/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

9eb

Office Action Summary	Application No.	Applicant(s)	
	09/955,668	SATO ET AL.	
	Examiner	Art Unit	
	Wesley A. Nicolas	1742	

-- Th MAILING DATE of this communication appears on the cov r sheet with the correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 August 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-91* is/are pending in the application.

4a) Of the above claim(s) *50-91* is/are withdrawn from consideration.

5)☒ Claim(s) *24-49* is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This is in response to the Applicant's election in the restriction requirement submitted August 21, 2003. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-91 are currently pending in this application, with claims 50-91 directed to a non-elected invention.

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: "Electrolytic Polishing Method".

Election/Restriction

2. Claims 50-91 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention **with** traverse, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 9.

However, since Applicant has not provided express admission that the claimed inventions are indistinct as required by Lee, the restriction as set forth in the previous Office action has been maintained. In re Lee, 199 USPQ 108 (Deputy Asst. Comm'r. for Pats 1978). Accordingly, the restriction requirement is now made **FINAL**.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-7, 11-16, 18-19, and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. 6,447,668 B1), and further in view of Ashjaee et al. (U.S. 2001/0035354 A1).

Wang teaches a polishing method for polishing an object having a film on a surface to be polished, comprising the steps of:

- measuring data corresponding to a thickness of the film on the object and making a relatively small cathode member compared with the surface face a region of the surface (Abstract, col. 22, and Fig. 7: "endpoint detector"),
- interposing an electrolytic solution at least between that region of the surface and the cathode member (Fig. 11A where solution is indicated by flowing arrows, surface is numeral 31 and cathode member can be numerals 1, 2, or 3), and

- in that state applying a voltage with the cathode member serving as a cathode and the film as an anode to electrolytically polish and flatten the film by electrolytic elution in that region of the surface preferentially from projecting portions of the film until removing a target amount of the film obtained from the thickness equivalent data (col. 11); wherein

Wang fails to specifically teach the process of moving the cathode member to another region of the surface and electrolytically polishing the film in that other region until removing the target amount of film to flatten the film is repeated over the entire surface, to thereby remove the target amount of film over the entire surface.

Ashjaee et al. teach the process of moving the cathode member to another region of the surface and electrolytically polishing the film in that other region until removing the target amount of film to flatten the film is repeated over the entire surface, to thereby remove the target amount of film over the entire surface (Fig. 16, were electrode 9 is smaller than wafer 16. It should be noted that Ashjaee et al. can operate in either electrodeposition or electroetching modes).

Claims 1, 4, and 6 are rejected because it would have been obvious and within the ordinary skill in the art at the time the invention was made to have modified the Wang invention to use the movement of Ashjaee et al. because Ashjaee et al. teach that the cathode is moved to another region to etch the surface of the substrate (¶ 0063 and Fig. 16, were electrode 9 is smaller than wafer 16. It should be noted that Ashjaee et al. can operate in either electrodeposition or electroetching modes) which would have increased the overall uniformity of the treated layer.

Claim 2 is rejected because Wang teaches that the film comprises a copper film (cols. 7-9).

Claim 3 is rejected because Wang teaches a step of calculating the amount of the film to be removed from the thickness equivalent data after the step of measuring the thickness equivalent data and before the step of electrolytically polishing and flattening the film by electrolytic elution in that region of the surface (cols. 10-12).

Claim 5 is rejected because Wang teaches that the speed of movement of the cathode member is controlled in accordance with the target amount of the film to be removed obtained from the thickness equivalent data (cols. 11 and 12).

Claim 7 is rejected because Wang teaches that the thickness equivalent data of the film, the thickness of the film is measured (cols. 14 and 15 where thickness is determined by electrical resistance).

Claim 11 is rejected because the feature of applying a stronger electric field to a projecting portion is considered to be an inherent property, and similar processes can reasonably be expected to yield products which inherently have the same properties. In re Spada, 15 USPQ2d 1655 (CAFC 1990). In this case, one of ordinary skill in the art would reasonably expect that a projecting portion of a substrate would incur a higher electric field not only because points concentrate electric field lines but because a projecting portion would be closer to the counter electrode thereby having an increased electric field in that location compared to spots which are further away from the counter electrode.

Claim 12 is rejected because Wang teaches that the surface has a projecting and recessed pattern formed by repeating a projecting and recessed pattern in that region of the surface, and by moving the cathode member stepwise to other regions of the surface and applying the stronger electric field to the projecting portion than to the recessed portion of the film corresponding to the unevenness of the film in these other regions, the step of electrolytically polishing and flattening the film by electrolytic elution preferentially from projecting portions of the film is repeated over the entire surface (col. 12 and Figs. 7A and 11A where numerals 1, 2, and 3 make up the recessed pattern and cathodes 1, 2, and 3 are separated by a dielectric walls 109, 107, 105, 103, and 101).

Claim 13 is rejected because Wang teaches that the cathode member is divided into a plurality of regions which are arranged insulated from each other and the cathode member as a whole faces the entire surface, and by changing the position of application of voltage to the divided cathode member, the substantially equivalent is obtained as when changing the position of the cathode member facing the surface from one region to another region (col. 12 and Figs. 7A and 11A where numerals 1, 2, and 3 make up the recessed pattern and cathodes 1, 2, and 3 are separated by a dielectric walls 109, 107, 105, 103, and 101).

Claim 14 is rejected because Wang teaches that the cathode member is divided into a plurality of concentric circular regions, and the entire surface is electrolytically polished by changing the position of application of voltage from the inner side to the outer side of the cathode member divided into concentric circular regions (col. 12 and

Figs. 7A and 11A where numerals 1, 2, and 3 make up the recessed pattern and cathodes 1, 2, and 3 are separated by a dielectric walls 109, 107, 105, 103, and 101).

Claim 15 is rejected because Wang teaches that when making a relatively small cathode member compared with the surface face that region of the surface, an anode member set apart from the cathode member at a certain distance is made to face the surface, an electrolytic solution is interposed at least between that region of the surface and the cathode member and between the surface and the anode member, and a voltage is applied to the cathode member and the anode member so as to apply the voltage de facto with the cathode member as a cathode and the surface as an anode (col. 12).

Claim 16 is rejected because although neither Wang nor Ashjaee et al. specifically teach an anode which is comprised of a nobler metal than the material on the surface, that feature would have been obvious and within the ordinary skill in the art at the time the invention was made because it is well within the skill in the art that a nobler metal (*i.e.* platinum, titanium, etc.) would have resisted either dissolution or corrosion which would have increased the overall life of the anode.

Claim 18 is rejected because Wang teaches that when a voltage is applied with the cathode member as a cathode and the surface as an anode, a direct-current voltage is applied (col. 13).

Claim 19 is rejected because Wang teaches that a rectangular pulse voltage is applied (col. 13).

Claim 21 is rejected because Wang teaches that in the step of electrolytically polishing and flattening the film by electrolytic elution in that region of the surface, an electrolytic current of the electrolytic polishing in the region is measured at the same time (cols. 13 and 14).

Claim 22 is rejected because Wang teaches that the voltage applied with the cathode member as a cathode and the surface as an anode is controlled to maintain the electrolytic current constant (cols. 13 and 14).

Claim 23 is rejected because Wang teaches that the progress in flattening the film in that region of the surface is managed through the electrolytic current (cols. 13 and 14).

6. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over the Wang - Ashjaee et al. combination, as applied to claim 1 above, and further in view of Talieh (U.S. 2003/0006147 A1).

The Wang - Ashjaee et al. combination are as applied, argued, and disclosed above and incorporated herein but fails to specifically disclose the simultaneous steps of chemical mechanical polishing and electrolytic elution of the surface.

Talieh teach the simultaneous steps of electrolytic action and chemical mechanical polishing (Abstract and Fig. 2).

Claim 17 is rejected because it would have been obvious and within the ordinary skill in the art at the time the invention was made to have modified the Wang - Ashjaee et al.

combination and performed chemical mechanical polishing at the same time as electrolytic elution as taught by Talieh because Talieh teach the use of chemical mechanical polishing which would have removed the peaks on the substrate (Abstract and Fig. 2) which would have provided a uniformly flat substrate. While Talieh teaches electrolytic deposition (not etching), one of ordinary skill in the art would have easily reversed the polarity and changed the electrolyte to etch instead of plate.

7. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over the Wang - Ashjaee et al. combination, as applied to claim 15 above, and further in view of Ichinose et al. (6,491,808 B2).

The Wang - Ashjaee et al. combination are as applied, argued, and disclosed above and incorporated herein but fails to specifically disclose the use of alternating current.

Ichinose et al. teach the use of alternating current when electrolytically etching (col. 4).

Claim 20 is rejected because it would have been obvious and within the ordinary skill in the art at the time the invention was made to have modified the Wang - Ashjaee et al. combination to use alternating current as taught by Ichinose et al. because Ichinose et al. teach the use of an alternating current voltage which preferably enables control of line width and control of treatment time (col. 4).

Allowable Subject Matter

8. Claims 24-49 are allowed over the prior art of record.

9. Claim 8 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 8, the specific method steps of measuring the thickness equivalent data of the film, the thickness equivalent data of the film in the region where the cathode member faces the surface is measured, and the process of moving the cathode member to another region of the surface, measuring the thickness equivalent data of the film in that other region, and electrolytically polishing and flattening the film by electrolytic elution preferentially from projecting portions of the film in that other region until removing the target amount of the film obtained from the thickness equivalent data is repeated over the entire surface was not taught or suggested by the prior art of record.

Regarding claim 24, the specific polishing method which includes:

- interposing an electrolytic solution including a chelating agent at least between that region of the surface and the cathode member, and
- in that state applying a voltage with the cathode member serving as a cathode and the film as an anode to oxidize the surface of the film by anodic oxidation and form a chelate film of the oxidized material; and
- selectively removing a projecting portion of the chelate film corresponding to unevenness of the film to expose the film of the projecting portion at the surface; wherein a step of moving the cathode member from one region to an other region of the surface, the chelate film forming step, and the chelate film removing step are repeated until removing the target amount of the film determined from the thickness equivalent data over the entire surface to flatten the entire surface was not taught or suggested by the prior art of record.

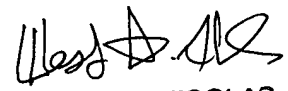
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley Nicolas whose telephone number is (703)305-0082. The examiner can normally be reached on Mon.-Thurs. from 7am to 5pm.

The Supervisory Primary Examiner for this Art Unit is Roy King whose telephone number is (703) 308-1146.

The fax number for this Group is (703) 872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.



WESLEY A. NICOLAS
PATENT EXAMINER

October 17, 2003